REMARKS

In view of the above amendments and the following remarks, reconsideration of the outstanding office action is respectfully requested. Pursuant to 37 CFR § 1.121, attached as Appendix A is a Version With Markings to Show Changes Made.

The rejection of claims 1-31 under 35 U.S.C. § 112 (2nd para.) for indefiniteness is respectfully traversed in view of the above amendments.

The rejection of claims 9-14 under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 5,900,443 to Stinnett et al. ("Stinnett I") is respectfully traversed in view of the above amendments to claim 9 and the cancellation of claims 10-14.

The rejection of claims 9-14 under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 5,473,165 to Stinnett et al. ("Stinnett II") is respectfully traversed in view of the above amendments to claim 9 and the cancellation of claims 10-14.

The rejection of claims 1-7 and 9-14 under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 4,376,794 to Machi et al. ("Machi") is respectfully traversed in view of the above amendments and the following remarks. The rejection of claims 10-14 is obviated in view of the cancellation of these claims.

Machi discloses a process for the production of a separator for use in a cell which includes irradiating a polymer film with ionizing radiation, contacting the irradiated film with an aqueous solution of a terminally unsaturated monomer to cause grafting of the monomer onto the film, and then treating the grafted film with an aqueous alkali solution.

In contrast, amended claim 1 (and its dependent claims 2-7 and 9) is directed to a "method for reforming the surface of a polymer membrane comprising irradiating energized ionic particles on the surface of the polymer membrane . . . under conditions effective to change pore size and shape of the polymer membrane." Machi neither discloses nor suggests a method for reforming the surface of a polymer membrane which includes irradiating energized ionic particles on the surface of the polymer member under conditions effective to cause a change in pore size and shape of the polymer membrane, as required by claims 1-7 and 9 of the present application. Therefore, the rejection based on this reference is improper and should be withdrawn.

The rejection of claims 1-3 and 9-14 under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 5,282,965 to Urairi et al. ("Urairi") is respectfully traversed in

view of the above amendments and the following remarks. The rejection of claims 10-14 is obviated in view of the cancellation of these claims.

Urairi discloses a method for obtaining a membrane filter for liquids which has been rendered hydrophilic which includes rendering the surface of a fluorine-containing porous polymer membrane hydrophilic by treating the surface with a low temperature plasma under specific conditions.

In contrast, amended claim 1 (and its dependent claims 2-3 and 9) is directed to a "method for reforming the surface of a polymer membrane comprising irradiating energized ionic particles on the surface of the polymer membrane . . . under conditions effective to change pore size and shape of the polymer membrane." Urairi neither discloses nor suggests a method for reforming the surface of a polymer membrane which includes irradiating energized ionic particles on the surface of the polymer member under conditions effective to cause a change in pore size and shape of the polymer membrane, as required by claims 1-3 and 9 of the present application. Therefore, the rejection based on this reference is improper and should be withdrawn.

The rejection of claims 1-6 and 9-14 under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 4,885,077 to Karakelle et al. ("Karakelle") is respectfully traversed in view of the above amendments and the following remarks. The rejection of claims 10-14 is obviated in view of the cancellation of the claims.

Karakelle teaches a method for preparing a composite, hydrophilic, ion permeable membrane, the resulting membrane, and a biosensor including the membrane. The method includes coating a polymeric base membrane with a monomer of a hydrophilic polymer and plasmapolymerizing the monomer.

In contrast, amended claim 1 (and its dependent claims 2-6 and 9) is directed to a "method for reforming the surface of a polymer membrane comprising irradiating energized ionic particles on the surface of the polymer membrane . . . under conditions effective to change pore size and shape of the polymer membrane." Karakelle neither discloses nor suggests a method for reforming the surface of a polymer membrane which includes irradiating energized ionic particles on the surface of the polymer member under conditions effective to cause a change in pore size and shape of the polymer membrane, as required by claims 1-6 and 9 of the present application. Accordingly, the rejection based on this reference is improper and should be withdrawn.

The rejection of claims 1-6 and 9-14 under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 5,028,332 to Ohnishi et al. ("Ohnishi") is respectfully traversed in view of the above amendments and the following remarks. The rejection of claims 10-14 is obviated in view of the cancellation of the claims.

Ohnishi relates to a method of manufacturing a hydrophilic material, the resulting material, and its use for porous membranes. The method involves subjecting at least part of the surfaces of a membrane substrate of a polymer material to a plasma treatment to thereby produce a polymer radical on the surfaces and graft polymerizing with the polymer radical a block copolymer containing a hydrophilic monomer supplied in the gaseous phase and a subsequently supplied hydrophobic monomer.

In contrast, amended claim 1 (and its dependent claims 2-6 and 9) is directed to a "method for reforming the surface of a polymer membrane comprising irradiating energized ionic particles on the surface of the polymer membrane . . . under conditions effective to change pore size and shape of the polymer membrane." Ohnishi neither discloses nor suggests a method for reforming the surface of a polymer membrane which includes irradiating energized ionic particles on the surface of the polymer member under conditions effective to cause a change in pore size and shape of a polymer membrane, as required by claims 1-6 and 9 of the present application. Therefore, the rejection based on this reference is improper and should be withdrawn.

The rejection of claims 9-14 under 35 U.S.C. § 102(b) as being anticipated by Korean Laid-Open Patent Publication No. 96-37742 ("Publication No. 96-37742"), as discussed on page 4 of the specification, is respectfully traversed in view of the above amendments to claim 9 and the cancellation of claims 10-14.

The rejection of claims 9-14 under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 5,965,629 to Jung et al. ("Jung") is respectfully traversed in view of the above amendments to claim 9 and the cancellation of claims 10-14.

The rejection of claims 9-14 under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 5,783,641 to Koh et al. ("Koh") is respectfully traversed in view of the above amendments to claim 9 and the cancellation of claims 10-14.

The rejection of claims 1-3, 6, 8-20, 23, 24, 27, 29, and 30 under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 4,845,132 to Masuoka et al. ("Masuoka") is respectfully traversed in view of the above amendments and the following remarks.

Masuoka teaches a hydrophilic porous membrane, a plasma separator using the hydrophilic porous membrane, and a method of producing a hydrophilic porous membrane by irradiating the outer surface of a hydrophobic porous membrane with plasma, feeding hydrophilic monomer in a gaseous state, and allowing the hydrophilic monomer to be graft polymerized on the surface of the porous membrane. Masuoka teaches that the hydrophilic porous membrane exhibits prominent dimensional stability and strength while in use, and discloses a blood plasma separator that uses the hydrophilic porous membrane.

In contrast, amended claim 1 (and its dependent claims 2-9) is directed to a "method for reforming the surface of a polymer membrane comprising irradiating energized ionic particles on the surface of the polymer membrane . . . under conditions effective to change pore size and shape of the polymer membrane" and amended claim 15 (and its dependent claims 16-30) is directed to "[a] method for providing hydrophilicity or increased hydrophobicity to the surface of a polymer membrane comprising: inserting a polymer membrane into vacuum chamber and irradiating the surface of the polymer membrane with energized ionic particles . . . under conditions effective to change pore size and shape of the polymer membrane . . . ." Masuoka neither discloses nor suggests a method which includes irradiating energized ionic particles on the surface of the polymer member under conditions effective to cause a change in the pore size and shape of a polymer membrane, as required by the claims of the present application. Thus, the rejection based on this reference is improper and should be withdrawn.

The rejection of claims 1-7 and 9-30 under 35 U.S.C. § 103(a) as being unpatentable over Publication No. 96-37742, as discussed on page 4 of the specification, Jung, or Koh, each in view of Masuoka is respectfully traversed in view of the above amendments and the following remarks.

Masuoka does not overcome the above-noted deficiencies of Publication No. 96-37742, Jung, and Koh. Therefore, the rejection of claims 1-7 and 9-30 under 35 U.S.C. § 103(a) should be withdrawn.

The rejection of claim 8 under 35 U.S.C. § 103(a) as being unpatentable over Publication No. 96-37742, as discussed on page 4 of the specification, Jung, or Koh, each in view of Masuoka as applied to claim 1, and further in view of U.S. Patent No. 4,346,142 to Lazear et al. ("Lazear") is respectfully traversed.

Lazear discloses a process for rendering a normally hydrophobic polyolefinic open cell microporous film relatively permanently hydrophilic, improving the water flow rate therethrough, and reducing the electrical resistance thereof by chemically fixing a controlled amount of at least one hydrophilic organic hydrocarbon monomer to the surface of the micropores of the film with ionizing radiation.

Lazear does not overcome the above-noted deficiencies of Publication No. 96-37742, Jung, Koh, and Masuoka. Therefore, this rejection is improper and should be withdrawn.

The rejection of claims 1-7, 9-25, and 27-30 under 35 U.S.C. § 103(a) as being unpatentable over Masuoka is respectfully traversed in view of the remarks above.

The rejection of claim 8 under 35 U.S.C. § 103(a) as being unpatentable over Masuoka in view of Lazear is respectfully traversed in view of the remarks above.

In view of all of the foregoing, applicants submit that this case is in condition for allowance and such allowance is earnestly solicited.

Respectfully submitted,

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June 12, 2002 — Ruth R. Smith

Date — Ruth R. Smith

Appendix A

Version With Markings to Show Changes Made

In reference to the amendments made herein to claims 1, 3, 6, 7, 9, 15, and 17-31, additions appear as underlined text, while deletions appear as bracketed text, as indicated below:

In The Claims:

1. (Amended) A method for reforming the surface of a polymer membrane [including a step of] comprising irradiating energized [ion] ionic particles on the surface of the polymer membrane under vacuum condition and under conditions effective to change pore size and shape of the polymer membrane.

3. (Amended) [A] The method in accordance with claim 1, wherein the ionic particles are produced from one or more [of types of particles] ion generating gases selected from [a] the group [comprising] consisting of electron, hydrogen, oxygen, nitrogen, helium, fluorine, neon, argon, krypton, air, and N_20.

6. (Amended) [A] The method for reforming the surface of a polymer membrane in accordance with claim 1, wherein the material of the polymer membrane is [selected from] a polyolefin [group comprising] selected from the group consisting of polypropylene, high density [polyeyhlene] polyethylene (HDPE), low density polyethylene (LDPE), and linear low density polyethylene (LLDPE).

7. (Amended) [A] The method for reforming the surface of a polymer membrane in accordance with claim 1, wherein the material of the polymer membrane is [one or more] a polyolefin blend or polyolefin [laminates selected from a polyolefin] laminate, wherein the polyolefins are selected from the group [comprising] consisting of polypropylene, high density [polyeyhlene] polyethylene (HDPE), low density polyethylene (LDPE), and linear low density polyethylene (LLDPE).

9. (Amended) [A] The method in accordance with claim 1, wherein the polymer membrane is a separator for a lithium ion secondary battery or alkali secondary battery [using polymer membrane of which the surface is reformed by a method of claim 1].

15. (Amended) A method for providing hydrophilicity or increased hydrophobicity to [reforming] the surface of a polymer membrane [includes the steps of] comprising:

a) [manufacturing a polymer membrane including the surface activated by] inserting a polymer membrane into a vacuum chamber and [by] irradiating [energized ionic particles on] the surface of the polymer membrane with energized ionic particles under a high vacuum and under conditions effective to change pore size and shape of the polymer membrane; and

b) [manufacturing polymer membrane treated with a reactive gas reacted on the surface of] treating the surface-activated polymer membrane [including the activated surface of the above] obtained in step a) by infusing [the] a reactive gas [after the energized ionic particles of the above step a) have been irradiated] onto the surface of the polymer membrane to cause reaction of the gas with the polymer membrane surface.

17. (Amended) [A] The method [for reforming the surface of polymer membrane] in accordance with claim 15, wherein the reactive gas infusion of step b) is made without interference of the ionic particles.

18. (Amended) [A] The method [for reforming the surface of polymer membrane] in accordance with claim 15, wherein ion beam irradiation of the step a) and reactive gas infusion of step b) are sequentially made.

19. (Amended) [A] The method [for reforming the surface of polymer membrane] in accordance with claim 15, wherein energized ionic particles of step a) are irradiated on one side or two sides of the polymer membrane.

20. (Amended) [A] The method [for reforming the surface of polymer membrane] in accordance with claim 15, wherein the ionic particles of step a) are produced from one or more [particles] ion generating gases selected from [a] the group [comprising] consisting of electron, hydrogen, oxygen, helium, nitrogen, oxygen, air, fluorine, neon, argon, krypton, N_20, and their mixtures.

21. (Amended) [A] The method [for reforming the surface of polymer membrane] in accordance with claim 15, wherein the dose of irradiation of step a) is from [10^5] 10^3 to 10^{20} ion/cm^2.

22. (Amended) [A] The method [for reforming the surface of polymer membrane] in accordance with claim 15, wherein the energy of ionic particles of step a) is from 10^{-2} to 10^7 keV.

23. (Amended) [A] The method [for reforming the surface of polymer membrane] in accordance with claim 15, wherein the high vacuum of step b) is 10^{-2} to 10^{-8} torr.

24. (Amended) [A] The method [for reforming the surface of polymer membrane] in accordance with claim 15, wherein the reactive gas of step b) is infused until the pressure of the vacuum chamber reaches the range of 10^{-6} to 10^4 torr.

25. (Amended) [A] The method [for reforming the surface of polymer membrane] in accordance with claim 15, wherein the infusion rate of the reactive gas of step b) is 0.5 to 1000 *ml*/min.

26. (Amended) [A] The method [for reforming the surface of polymer membrane] in accordance with claim 15, wherein the reactive gases of step b) are one or more gases selected from [a] the group [comprising] consisting of helium, hydrogen, oxygen, nitrogen, air, ammonia, carbon monoxide, carbon dioxide, carbon tetrafluoride, methane, N_20, and their mixtures.

27. (Amended) [A] The method [for reforming the surface of polymer membrane] in accordance with claim 15, wherein the material of the polymer membrane of step a) is [selected from] a polyolefin selected from the group [comprising] consisting of polypropylene, high density [polyeyhlene] polyethylene (HDPE), low density polyethylene (LDPE), and linear low density polyethylene (LLDPE).

28. (Amended) [A] The method [for reforming the surface of polymer membrane] in accordance with claim 15, wherein the material of the polymer membrane of step a) is [one or more] a polyolefin [blends] blend or polyolefin [laminates selected from a polyolefin] laminate, wherein the polyolefins are selected from the group [comprising] consisting of polypropylene, high density [polyeyhlene] polyethylene (HDPE), low density polyethylene (LDPE), and linear low density polyethylene (LLDPE).

29. (Amended) [A] The method in accordance with claim 15, wherein the polymer membrane is a separator for a battery [using the polymer membrane of which the surface is reformed according to the method of claim 15].

30. (Amended) [A separator for battery] The method in accordance with claim 29, wherein the battery is a lithium ion secondary battery or an alkali secondary battery.

31. (Amended) A method for providing hydrophilicity or increased hydrophobicity to [reforming] the surface of a polymer [includes the steps of] comprising:

a) [manufacturing a polymer including the surface activated by] inserting a polymer into a vacuum chamber and [by] irradiating [energized ionic particles on] the surface of the polymer with energized ionic particles under high vacuum and under conditions effective to change pore size and shape of the polymer; and

b) [manufacturing polymer treated with a reactive gas on the surface of polymer including] treating the [activated surface of the above] surface-activated polymer obtained in step a) by infusing [the] a

reactive gas [after the energized ionic particles of the above step a) have been irradiated] onto the surface of the polymer membrane to cause reaction of the gas with the polymer surface.